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ABSTRACT

Empirical findings on the efficiency of memory processes in exceptional children are outlined. Cognitive deficits are considered to be central to many academic and social skill problems of children with mental retardation and learning and behavior problems. In response, educators and psychologists have devised ways of training such students to use cognitive strategies to improve their performance. Analysis of students' cognitive styles of learning can provide insight into learning difficulties, through consideration of reflective and impulsive cognitive styles, field-dependence and field-independence, memory, active and passive cognitive styles, and causal attributions and internal/external loci of control. Cognitive strategy training can be applied to such instructional techniques as self-instruction, self-questioning, self-monitoring, and memory strategies, but several limitations have been identified. An experiment tested the results of restrictions on voluntary cognitive control strategy use for 24 retarded and 24 nonretarded students (aged 10-14) during tasks lending themselves to use of these strategies. Retarded students demonstrated slower than normal and less efficient stimulus encoding, as well as deficits in the speed of information processing and faster than normal stimulus decay. The study concluded that less emphasis should be placed on cognitive strategy training procedures for the midly retarded child than for the learning-disabled child. A list of references is provided. (JDD)

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Cognitive Strategy Training: Implications, Applications, Limitations

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Presented at the 65th International Convention
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Chicago, Illinois, 1987

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COGNITIVE STRATEGY TRAINING:

IMPLICATIONS, APPLICATIONS, LIMITATIONS

The 65th International Convention
of the Council for Exceptional Children
Chicago, Illinois, 1987

"IF YOU GIVE A STARVING MAN A FISH, YOU FEED HIM FOR A DAY; HOWEVER, IF YOU TEACH THE STARVING MAN TO FISH, YOU FEED HIM FOR A LIFETIME. SIMILARLY, IF YOU TEACH A LEARNING-DISABLED CHILD A FACT, YOU HELP HIM FOR THE MOMENT; IF YOU TEACH THE CHILD HOW TO THINK ABOUT LEARNING, YOU HELP HIM FOR A LIFETIME"

Old Chinese proverb

The efficiency of memory processes in exceptional children has long been of both theoretical and practical interest. Dating back to Galton (1887), Jacobs (1887), and Binet (1904; cited by Campione & Brown, 1977), memory deficits have been seen as characteristic of retarded individuals. One index of intelligence is a well-developed knowledge system and the capability of retrieving relevant items of knowledge when a problem is presented.

Memory items and/or subtests have been included in almost every comprehensive individual and group intelligence test since the beginning of the testing movement. At age twenty months on the Bayley Mental Scale of Infant Development one test item requires the baby to recall, after a short retention interval, under which of two cups an object has been hidden. On the Stanford-Binet, a similar three-choice short-term memory item is placed at age two years. Memory items are also included on all of the Wechsler scales of intelligence, as well as the McCarthy scales.

Memory has been studied by philosophers and psychologists for centuries. The search has been for those factors which assist us in remembering or cause us to forget. Bower and Hilgard (1981) describe memory as "the faculty of retaining and recalling past experiences, or the ability to remember" (p. 2). Richter (1966) defines memory as the capacity of an organism to behave in a way which is modified by previous experience. Webster's New College Dictionary (1981) defines memory as "the power or process of reproducing or recalling what has been learned and retained, especially through associative mechanisms; the store of things learned and retained from an organisms' activity or experience as evidenced by modification of structure of behavior or by recall and recognition" (p. 711). At a most basic level, memory may be thought of as consisting of three main parts or stages: Encoding (acquisition), retention (storage), and retrieval. First, the person experiences or perceives some event; the experience is registered through the sensory receptors, and is initially coded by the central nervous system. Retention or storage involves holding information which has been encoded; information in storage has been retained or learned. The retention stage refers to that period when the person is not consciously thinking about the event. The third phase of memory is retrieval, in which a concept is remembered or dredged up so that it may be utilized in guiding performance (Robinson & Robinson, 1976). Memory is considered to be measurable by means of recall, recognition, or relearning tests or tasks. Failure to use cognitive strategies such as chunking, organization, coding, rehearsal, and mnemonic devices have been implicated as important in the inferior performance of mentally retarded subjects on experimental tasks involving short-term memory (Borkowski & Cavenaugh, 1979, Bray, 1979; Ellis, 1970; Evans, 1964; Glidden, 1979; Spitz, 1966). In the most general sense, a cognitive strategy is an

activity undertaken by a person for the purpose of coping with the requirements of a task. In many memory tasks, persons are required to remember information for a longer period of time than allowed by the limitations of immediate memory. Without the use of a strategy to cope with these limitations, later performance may be poor. Strategies such as rehearsal, chunking, categorizing, clustering, coding and mnemonics may be used to cope with task demands, but these are reportedly not spontaneously used by retarded individuals (Brown, 1974; Campione & Brown, 1977; Butterfield & Belmont, 1977).

Ellis (1963) originally hypothesized that the major memory deficits in mentally retarded persons lay in lowered central nervous system integrity which results in faster loss from short-term store (STS) by retarded children than by normal children of the same age. This structural point of view is not necessarily physiological; however, possible neurophysiological mechanisms have been hypothesized. Ellis suggested that the basis for normal short-term store (STS) function was a brief reverberatory trace or circuit, which he termed "stimulus trace." The "stimulus trace" ordinarily decays very quickly, but while it persists it may produce changes in the brain which results in storage of information. He suggested that in the mentally retarded, the stimulus trace is both shortened in duration and lessened in intensity with consequent deficits in learning and retention. Another early theorist hypothesizing structural deficits in mentally retarded individuals was Spitz (1963), who generated evidence suggesting sluggishness, or torpidity, or cortical cells. If it requires a longer time to induce changes in the electrical, chemical, and physical condition of stimulated cortical cells in mentally retarded persons, they should learn and remember less well than normal individuals, given the same

amount of stimulation and/or effort. Spitz further maintained that once changes have been introduced, they tend to persist and to be resistant to new information input. The cortical functions of retarded individuals, according to this theory, are sluggish and inflexible.

Some years later, Ellis (1970) revised his stimulus trace hypothesis and stated," (The current) studies provide evidence for two STM processes in normal and retarded subjects as well as evidence that retardates suffer a deficit in rehearsal strategies, a mechanism of central importance to short-term storage" (p.3). This may account for their poor performance on STM tasks when compared to nonretarded subjects.

Building upon and extrapolating from the theoretical foundations of the Waugh and Norman (1965) and the Atkinson and Shiffrin (1968) models of memory, Ellis (1970) proposed that items enter the system (after being registered through a sensory mechanism by means of attention) through a very short-term memory (VSTM) where item trace persistence is only the order of 250-2,000 msec. Researchers have studied VSTM structures of mentally retarded individuals in comparison with nonretarded persons matched for Mental Age (MA) and/or chronological age (CA) in attempts to define the structure similarities or differences between groups. In several studies the mentally retarded subjects were found to be deficient in VSTM (Headrick & Ellis, 1964; Likbuman & Friedrich, 1972; Pennington & Luszez, 1975). An attentional perceptual mechanism translates information from VSTM, and moves it to the next store in the system, primary memory (PM). Primary memory, unlike VSTM, is a limited capacity, short-term store. Its capacity is limited to a few items, perhaps three or four, but the definition of an item is not very precise. The capacity of PM seems to be about the same whether it is measured in terms of letters, words, or sentences (Glanzer & Razel, 1974). Primary memory is sometimes

conceptualized in terms of a limited number of successive slots filled with items. A new incoming item displaces the item in the first slot, setting off a chain reaction that displaced, it will be forgotten unless something is done to preserve it. Scott and Scott (1968) suggested that on tasks of short-term retention the mentally retarded are deficient in PM. Similarly, Dugas and Kellas (1974) found that the mentally retarded were deficient in performance on a scanning task and concluded that the deficit was due to a PM deficiency; this result is consistent with results obtained by Scott and Scott (1968) and was confirmed some years later in a study by Cohen and Sandberg (1977).

After information is stored in PM, rehearsal comes into play; rehearsal serves two functions. It may be used to recirculate an item through PM, thereby keeping it from being forgotten. The second function is to move an item from PM to secondary memory (SM). Secondary memory is a more permanent store than PM and is of larger capacity. An item is moved from PM to SM when it has been sufficiently rehearsed. Much of the interest in rehearsal in the mentally retarded was spurred by the theory and research of Ellis (1970), who concluded that the differential performance on memory tasks between mentally retarded and nonretarded individuals was due to the former's failure to use active rehearsal processes. It appeared that the retarded were suffering from a rehearsal deficit. Ellis (1970) found that on a variety of serial learning tasks, mentally retarded individuals performed as well as nonretarded subjects on items in the last few positions on the list (PM), but recalled significantly fewer items than normals from the early positions of the lists (a primary effect, reflective of SM). The retention interval defining SM is from seconds or minutes to hours or days. The mechanism of

forgetting appears to be interference. Unlike the Atkinson and Shiffrin model, the Ellis model describes a third memory store call tertiary memory (TM). Tertiary memory is a long-term store. To reach TM, information must be extensively rehearsed to the point of overlearning. Information in TM may never be forgotten; however, information may, in some cases, become inaccessible due to retrieval difficulties. The principal reason for including TM in the Ellis model is that it allows operational differentiation between very well-learned material such as a person's name or the basic words and rules of his/her native language and less well-learned material, such as a memorized telephone number that may be forgotten in a few minutes or days. In his review of the literature, Belmont (1966), found only one study (Klausmeier, Feldhusen, & Check, 1959), in which methodological difficulties did not preclude acceptance of conclusions about TM deficits. Klausmeier et al. (1959) found that high IQ children (over 120) learned rapidly and forgot rapidly whereas low IQ children (55-80) learned slowly and forgot slowly. Also retention was equal for high, average, and low IQ subjects when the original learning task was graded to the learners' achievement level; retention was reported to decrease over time for all groups on a variety of tasks.

Ellis was one of the first theorists to rely heavily on information-processing concepts in his explanation of memory deficits in mentally retarded persons. Within this multi-process memory framework, Ellis hypothesized that the retarded individual had a rehearsal deficit. This hypothesis was derived from the lack of primacy effects in a sequential memory task and from the finding that retarded individuals did not profit from increased exposure time in this task, whereas normal adults did. although structural features and limitations of the memory system are not denied (e.g., short-term store capacity, speed of processing, decay rates),

subjects' control of activities as they process stimuli is seen to be critical in whether and how much they learn and remember. The implication that a lack of spontaneous rehearsal was a factor provided impetus to many studies of control strategy memory deficits and efforts to teach strategies to mentally retarded students.

The heavy emphasis on strategy research during the past years has been accompanied by a reduction in research into possible nonstrategic (structural) deficits in the memory systems of the retarded. There are data to support the notion of a critical nonstrategic process being responsible for IQ related individual differences in memory performance. Recent evidence and re-examination of older findings invite reconsideration of the critical emphasis placed on control processes in short-term memory deficits of the mentally retarded. Consequently, theorists (Ellis, Deacon,& Wooldridge, 1985; Ellis & Meador, 1985; Ellis & Wooldridge, 1985), have reconsidered, updated, and altered Ellis' position in recent years to place a much stronger emphasis on the role that memory structure plays in the difference between retarded and nonretarded subjects on tasks involving short-term memory. In a 1985 report, Ellis and Meador stated: "Most of the (short term memory) research in the last decade has been directed to the study of control processes and, in fact, studies of structural processes are rare. However, the possibility of structural differences (between retarded and nonretarded subjects) in cognitive functioning remains. They may be fundamental deficits which give rise to control deficits, and/or may set limits within which control processes may vary" (p. 87). Mann (1985) suggests: "All IPS (information processing systems)

components are structurally limited in their information-processing capacities " (166). However, in some individuals systems are more structurally limited than in others.

The destination between control processes (mechanisms) and structural features, proposed by Atkinson and Shiffrin 91968) and emphasized in the area of retardation by Fisher and Zeaman (1973), seems deceptively simple. Structural features are invariant components of the system somewhat akin to the microchips of a computer. As such, these aspects are unmodifiable an din the study of retarded individuals the term "structural deficits" refers to areas of functioning where training would be ineffective. These structural features of memory refer to those aspects of the system which are not programmable; they cannot be varied or changed due to some theoretical structural limitation of the organism. "Although it might be possible to teach a retarded child indirect means of compensating for such a (structural) deficiency just as one can teach a blind child to read through his fingers, it should be impossible to change the (electrical, structural circuitry of information flow, chemical, or capacity) system directly, just as it is impossible to restore sight to a child whose optic nerves have been destroyed" (Robinson & Robinson, 1976, p. 290).

This point of view does not necessarily mean physiological structure, as in the abnormal structure of the brain of a child with gross brain disorder or a lesion due to trauma, insult, or disease; it refers to structural features or structural limitations in the sense of rapid decay or loss of information, or the actual flow, or lack of flow of information through the various theoretical stores, or the ability to encode a stimulus adequately for retrieval, or even the inability to allow for spontaneous rehearsal and other control mechanisms due to some unknown parameter. control processes, however, are seen as optional strategies that an

individual brings to bear on memory tasks. Any control process can be used, or not used, at the choice of the individual. The implication is that the use of control processes (such as organization, chunking, rehearsal, codifying, or mnemonic applications) is trainable; that is, they are not an invariant part of the memory system. While structural features are essentially constant, the choice of control mechanisms can vary widely. To reiterate, the essential difference between structural and control failures lies in their susceptibility to training. Control deficiencies are, by definition, trainable, while structural features are not. For example, normal and even mentally retarded children can be taught (with a great deal of time an effort in the case of the mentally retarded) to employ a rehearsal strategy, although the children may not continue to employ this strategy after the prompting has ceased. There is little evidence to suggest that retarded subjects generalize newly taught strategies to novel stimuli and tasks (Campione & Brown, 1977). A distinction very similar to that between structural features and control processes is the one drawn between production and mediation deficiencies (Flavell, 1970). The practical distinction lies in the ability of the subject to profit from training. As with a structural deficient, a mediational strategy even when instructed to do so; a subject could be trained to rehearse items, for example, but this activity fails to improve performance. A production deficiency, on the other hand, involves the subject's failure to produce or employ a strategy or a control process, even though capable of producing an during it; this is an inadequate use of control processes, and can be remedied by adequate training of a required strategy. However, Flavell's (1970) theory of production/mediational deficiencies and Ellis' (1970) structural/control theory have differences.

Flavell adds an explanation of the difficulty of distinguishing between developmentally related untrainable components of the memory system and trainable processes, a problem of the distinction between mediational and production deficiencies. In other words, according to Flavell (1970), memory deficiencies may be thought of as existing on a developmental continuum. The distinction is between not having been trained even though one could be and not being developmentally at a point at which training is possible. However, a great problem continues to exist in establishing the presence of a mediational deficiency, for if training does not alter performance as time goes on, is this due to a mediational problem or inadequate training procedures?

In tandem with Flavell's theory, Campione and Brown (1978) speak of the various contexts in which "structures" and "structural limitation" have been referred to: (a) the hardware of the system, as in a computer metaphor; (b) the schemes as in the Piagetian sense; (c) limitations in the efficiency of various parts of the hardware (e.g., capacity limitations in STM, speed of encoding); and (d) any untrainable component of an individual's thought. "The picture is even more confusing if viewed in the context of development, for some of these various 'structures' are assumed to undergo no development (e.g., the hardware), clear development (Piagetian schemes), or may or may not change with age, ability and experience (limitations of the efficiency of the hardware)" (p. 283).

Zeaman and House (1979), who have focused on the structural, unmodifiable components of the information processing system, provided evidence to suggest that the sized of the rehearsal buffer (the capacity of the STM system), as well as several other parameters, are highly associated with level of intelligence, as is the ability to focus on more than one dimension on a discrimination learning task, termed breadth of attention.

Incidental learning, another selective attention task, has also been found to be related to intelligence.

IMPLICATIONS IN THE CLASSROOM:

Students with mental retardation and general learning and behavior problems typically show cognitive deficits. Cognitive deficits--deficits in though processes--seem to be at the heart of may of the academic and social skill problems of children with learning and behavior problems. Students with cognitive deficits do not have strategies for approaching academic tasks or social situations. Instead, they approach these tasks and situations in a disorganized, haphazard way, seemingly without thinking about what they are doing or how others will react to them. Thus, they are unable to perform academically as well as they might. In response, educators and psychologists have devised ways of training such students to use cognitive strategies to improve their performance in academic areas.(Hallahan, 1980; Hallahan, Hall, et al., 1983; Kauffman & Hallahan, 1979)

In order to conceptualize cognitive strategy training and its overlapping components of cognitive behavior modification, metacognition and comprehension and academic attack strategies in the special education setting, it is important to discuss them in light of some common cognitive styles of learning-disabled students.

I. COGNITIVE STYLES OF LEARNING

Cognitive strategy training is based on the findings of child development research and interest in how a child's cognitive approach to an academic or nonacademic situation influences the effectiveness of learning.

Cognitive style refers to the student's general behavior and attitude when presented with a learning task. Analysis of the student's cognitive style of learning provides insight into the learning difficulties.

REFLECTIVE AND IMPULSIVE COGNITIVE STYLES:

One way of analyzing styles of learning is to determine whether the student's learning behavior is reflective or impulsive. In the reflective style, the student proceeds with careful deliberation, considering alternatives before choosing a response to a problem. In the impulsive style, the student responds very quickly, without considering possible alternative responses. (Blackman & Goldstein, 1982; Kauffman, 1985)

Special needs students often respond in an impulsive style, a behavior that research suggests is detrimental to school performance. Impulsive students speak without first considering their thoughts and race through written assignments without monitoring right and wrong answers. In a matching figures task, they draw lines from one object to another without first inspecting the page. Impulsive students seem to come to decisions too quickly, without sufficient time between the stimulus and the response. This characteristic impulsive behavior of learning disabled students is basically due to a lack of alternative cognitive strategies. These students respond impulsively because they do not have other ways readily at hand for coping with the learning task. The obvious solution is to help them acquire an array of useful cognitive learning strategies.(Blackman & Goldstein, 1982).

FIELD-DEPENDENCE AND FIELD-INDEPENDENCE:

Someone who exhibits a field-dependent cognitive style is distracted by irrelevant environmental cues when perceptual judgment or interpretation is required. A special needs child who is highly field-dependent, for

example, might be unable to separate essential from nonessential information in reading a passage or listening to a lecture or a set of instructions from the instructor, and therefore miss the point or fail to comprehend. A student with a field-independent style, however, is able to separate essential from nonessential information in the perceptual field. The perceptions and interpretations of students with a field-independent style tend to be more accurate than those students who are field-independent. Researchers have found of course that a significant number of learning disabled students tend to be more field dependent than field independent learners. Generally, a test of embedded figures is used to assess this cognitive characteristic of exceptional children.

MEMORY

As discussed previously, memory involves holding or storing information mentally for later use. Both short-term and long-term memory have been studied extensively in children who are learning handicapped and nonhandicapped. Nonhandicapped children tend to perform rather well on short-term memory tasks, apparently because they employ what we call cognitive control memory strategies for remembering. They may, for example, group pictures to be remembered categorically in some way that makes them easier to remember. Or they may say the picture names to themselves and rehearse them over and over again in order to hold on to the image of the object. Learning handicapped students, on the other hand, typically do not use spontaneously any strategies for remembering and are usually found to be deficient in short-term memory ability. Swanson, 1979; Tarver, Hallahan, Kauffman, & Ball, 1976; Torgenson & Goldman, 1977). Consequently, they are not able to remember features of academic tasks long enough to perform adequately.

ACTIVE AND PASSIVE COGNITIVE STYLES:

Another way to view cognitive styles is to consider whether they are active or passive. Efficient learning requires an active and dynamic involvement in the learning process. Active learners efficiently use many cognitive strategies. They work at structuring the information (organization), asking themselves and the instructor questions about the material (self-questioning and general questioning strategies), and they compare the new information to what they already know (assimilations and accommodation). They are intensely involved and have a desire to learn.

Special needs students, on the other hand, have learned to approach the learning task in a passive manner (Alberto & Troutman, 1986). They lack interest in learning probably because past learning experiences were often dismal exercises in failure and frustration. Not believing that they can learn, learning-disabled students do not know how to go about the task of learning. As a consequence, they become passive and dependent learners, a style that has been referred to as "learned helplessness."

CAUSAL ATTRIBUTIONS; INTERNAL AND EXTERNAL LOCI OF CONTROL:

Causal attributions, in the context of a discussion of learning problems, have to do with what an individual child believes is responsible for his or her success or failure on academic tasks. It has been found that learning disabled students attribute their consistent failure on academic tasks to external, uncontrollable causes such as fate, probability, luck, or even God. In other words,sd they believe they have no control over their learning and the environment. Internally controlled learners believe that they control their learning and the environment in which learning takes place. They have learning strategies at their disposal, and know when to employ them in order to exert control over a

task and increase their chances of selecting the correct response or completing a learning task with a high level of accuracy.

II. LEARNING STRATEGIES AN INTRODUCTION:

Many educators advocate the teaching of cognitive strategies, which go far beyond and supplement the effective fuse of the basic skills. With cognitive strategy training, the basic skills of reading, writing, and mathematics are utilized, however, the instructional emphasis is placed upon teaching how to learn and to apply what is learned to all content areas and learning settings.

What cognitive strategies are used by people who learn in an efficient and well-functioning manner? Efficient learners seem to be able to control and direct their thinking processes in order to facilitate learning and to deal with abstract concepts needed for academic learning. Efficient learners ask themselves question; they organize their thoughts; they connect and integrate the new materials they are trying to learn with prior experience and knowledge they already possess; they try to predict what is to come; and they monitor the relevance of new information. Efficient learners exhibit an active interest in learning and solving problems. In other word, efficient learners have learned how to go about the business of learning and have at their disposal a repertoire of cognitive strategies that work for them.

A characteristic of learning disordered students in that they lack these functional cognitive learning strategies. They do not know how to control and direct their thinking to learn, how to gain more knowledge, or how to remember what they learn. Thus, what learning-disabled students need is specific instruction in how to learn. They must become aware of and acquire efficient cognitive strategies to facilitate learning and

remembering. Once learned, cognitive strategies can be used in many contexts. By knowing how to learn through the application of cognitive strategy training, which is going far beyond just knowing "what to learn", the special education student's chances for survival and success in the regular classroom are much improved. Fortunately, research shows that learning-disabled students do improve after instruction in specific strategies for learning. (Billings & Wasik, 1985; Meichenbaum, 1980; O'Leary, 1980; Reeve & Kauffman, in Press).

Cognitive strategies generally emcompass three overlapping concepts; cognitive behavior modification, comprehension monitoring, and metacognition training. Each concept, depending on how it is utilized, can be a subcomponent of another concept. (An example is that in order to use comprehension monitoring procedures, a cognitive behavior modification technique, one has to utilize metacognition.) It is difficult and somewhat misleading to speak of these three terms in isolation so I would like to relate them to some very specific instructional techniques that you can apply in your classroom with your very special group of learners:

III. INSTRUCTIONAL TECHNIQUES:

1. Self-Instruction-

This is the major thrust of cognitive strategy training. By teaching exceptional students to have a dialogue within themself and to be self-instructive we are helping him to become a proactive partner in his own learning, rather than a passive consumer. To have control from within, to ask questions, to follow a modeled procedure, and to adjust his approach to a particular task based on this internal, covert dialogue.

Self-instruction training involves teaching students who are trying to solve a problem to first ask themselves questions about the nature of the problem, the most effective approach to the task, the relevant stimuli, and the accuracy or quality required in their performance. Next, the students are taught to give themselves instructions regarding performance of the task that will make their cognitions about what they are doing more explicit and will guide their performance of the steps involved in solving the problem. Finally, students are taught to give themselves appropriate feedback and correction or reinforcement. The content of the self-task varies, depending on the nature of the tasks and the characteristics of the individual student.

Training in self-instruction usually begins with the teacher's modeling or demonstration of appropriate self-talk and proceeds through a sequence of steps leading, eventually, to the student's covert (i.e., silent or internal) self-instruction. Repeated trials--including additional modeling by the teacher, guided practice by the student, and the student's rehearsal of the procedure--are essential features of self-instruction training. The training sequence is often approximately as follows:

a. The Teacher performs the task while engaging in self-talk aloud--asking questions about the task, giving self-guiding instructions, and making self-evaluations of performance.

b. The student is asked to imitate the teacher's overt (aloud) self-instruction while doing the task.

c. The teacher performs the task, again modeling self-instruction but this time in a whisper.

d. The student imitates the teacher's whispered self-instruction.

e. The teacher models covert (silent) self-instruction while doing the task.

f. The Student imitates the teachers covert self-instruction.

An important feature of self-instruction is providing a "coping" model for students. Flawless performance is not characteristic of most activities performed by people. Students need to be taught that successful performers make mistakes but learn how to cope with them--how to correct them without getting upset or "losing it." Self-recognition of errors and self-correction are vital skills that the teacher should model.

A very closely related and sometimes overlapping concept to self-questions and self-monitoring is self-instructional procedures.

2. Self-Questioning and Self-monitoring-

Self-questioning and self-monitoring helps in training the special needs child to become more reflective in his or her classroom behavior. By going through a predetermined series of questions before impulsively raising his or her hand for help, the student may very well be able to solve the problem independently, freeing the teacher from answering a series of questions pertaining to instructions just given and allowing him or her to circulate and help a larger number of students.

These procedures involves having the student quietly (in a covert manner) asks him/herself questions about the material at hand; the questions may very well be printed on a 3 x 5 card taped to his desk. The steps consist of training the child to ask the following types of questions or to make the following statements:

(Spivack, Platt, & Shure, 1976; Camp & Bash, 1981)

a. What am I supposed to do?

b. I need to look at all my possibilities.

c. I have to focus in (concentrate).

d. I have to make a choice.

e. How well did I do? Good, I got it right. . . give yourself a point.

This process has also been referred to as verbal mediation. This internal language, or covert speech, helps organize material and behavior to increase the exceptional learners changes of improved accuracy or increasing appropriate behavior to maintain task involvement.

Self-monitoring (Hallahan & Kauffman, 1983, 1985) involves self-assessment, self-questioning, and self-recording. The student must become aware of his behavior as it relates to what is desirable and then keeps a record of his performance. Although self-monitoring can be used with a variety f behaviors, most of the research on this technique has been done with on-task behavior. Typically, the procedure has been used during seatwork, when on-task behavior can be clearly defined. Usually, a cassette tape recorder has been used to produce tones (prerecorded to sound at random intervals ranging from 10 to 90 seconds) that cue the student to self-assess and self-record. The student is instructed to ask himself, when he hears the tone, "Was I paying attention?" Depending on his answer to that question, he checks the appropriate yes or no column on a simple recording form. Reinforcement is than delivered on increasingly higher levels of "yes" responses. This procedure has also been used during group work with slight modifications: "Was I paying attention?" is written on the chalkboard, and students use mechanical counters or a check sheet to tally their answers.

3. MEMORY STRATEGIES-

Memory strategies are those designed to help students remember more information and retrieve it more quickly. As noted earlier, students with learning disabilities often appear not to use the memory strategies that

handicapped students devise spontaneously. However, these strategies can be taught to handicapped students, many of whom can then perform memory tasks on a part with their nonhandicapped age peers. Common memory strategies include the following:

a. Grouping, clustering, or organizing items logically into subclasses (finding common attributes of items and recalling them as subsets).

b. Rehearsing the recall of information (repeating it to oneself, usually subvocally).

c. Creating images (trying to visualize the information).

d. Paraphrasing (putting the information into one's own language).

e. Associating (pairing items with other information to be remembered)

Some memory strategies are know as "mnemonics." A mnemonic strategy involves encoding (or recoding), relating, and retrieving information. Recoding requires transformation of the material that is to be learned into a more meaningful form for the individual who wishes to remember it. Relating involves addition to or elaboration of the material so that helpful associations can be formed. Retrieving then requires using the associations to recall the recorded material. One mnemonic strategy that has been used with exceptional students is called the "keyword method" and is described by Mastropieri et al (1985).

For example, to remember that the Spanish vocabulary word "pato" (pronounced something like "pathoe") means duck, the learner first recodes the unfamiliar word "pato" into an acoustically similar and easily pictured keyword. In this case, a good keyword for "pato" would be pot, in that it sounds like a salient part of "pato" and is easily pictured. Second, in the relating stage, the recoded keyword (pot) is related to the unfamiliar word's meaning (duck) by means of an interactive picture or image. For

this example, a good interactive picture or image might be a duck with a pot on its head. Finally, when the learner is asked to the meaning of the word "pato", a direct systematic retrieval path has been established: The vocabulary word "pato" leads to the keyword pot, which in turn leads to the picture of the pot on the duck's head, which results in the desired definition (duck).

IV. LIMITATIONS OF COGNITIVE STRATEGY TRAINING:

Despite the strength of the rationale for meta cognitive skills or cognitive strategy training for learning-disabled students, certain constraints warrant consideration. Cognitive strategy training by no means is a panacea; it is simply one methodology by which we may approximate our goal of a more competent, efficient, surviving special needs learner.

The first constraint concerns the interpretation of the highly successful outcomes of cognitive strategy training. One must be cautious in the implications drawn from such successful intervention. It would be very wrong to make special students think that the sole cause of their poor performance at any given task is the lack of an appropriate metacognitive strategy. Failures at any given task--academic or experimental--have many causes, one of which may be strategic deficiency or inappropriateness. More important, in some situations, strategy may be relatively unimportant and other factors such as effort and ability may assume more prominence.(Katims, 1986).

Thus, a proper perspective on strategic intervention with learning-disabled persons is necessary, because occasionally the best response to a task failure consists of MORE than a strategy, such as improved knowledge base, and it would be harmful and erroneous for the student to presume that

only strategic variables are of concern. You as the special educator using these strategies must refrain from inadvertently generating this erroneous idea in the special student.

Again, a proper perspective on the contributions of cognitive strategy training to the special student. It is pertinent to note that metacognitive problems do not explain all of the special childs' poor learning and achievement in school.

Cognitive strategy training cannot explain the cognitive deficiencies such as decoding problems in the learning-disabled student. Additionally, such basic decoding problems affect the learning disabled students' reading comprehension because their slow and laborious decoding exhausts their information-processing capacities, leaving little cognitive resources for understanding what is read.

An exclusive focus on cognitive strategy training in the curriculum is not appropriate because of the neglect in other essential content skills, as well as areas that this type of training does not lend itself to such as emotions, self-perceptions, belief systems, and self-esteem.

And finally, and perhaps the most important limitation to consider is the child that strategy training has not been highly successful with. since the late 1960s and early 1970s there has been a trend toward a noncategorical or generic model for the delivery of services to students with mild learning impairments. Today, you would certainly not be hard pressed to find classes in every state in the country where learning disabled, mild mentally retarded, and emotionally handicapped children are placed side by side in the same environment. Those who are proponents of this model of service delivery believe that the children who "fall" into these traditional categories of exceptionality share more common regard to educational needs, than they do not share in common.

This is where our research suggests the problem begins for the mildly retarded child who may be working side-by-side in the same educational environment as the learning disabled child.

Recent evidence and a re-examination of older findings invite reconsideration of the critical emphasis placed on cognitive control strategies, such as metacognition and rehearsal strategies in the short-term memory deficits of some types of special students; specifically the mentally retarded student--and when considered within the context of the noncategorical setting, the mildly mentally retarded student.

In the past, like their learning disabled counterpart, mentally retardation childrens' deficits in cognitive strategies were attributed to a failure in the spontaneous use of voluntary cognitive control memory strategies such as verbal rehearsal, chunking, associations, and the use of mnemonic devices.

We think there is more here than meets the eye: We know that we can improve a nonretarded and learning disabled child's use of cognitive control strategies through cognitive strategy training--that is what this session is all about.

So what happens when we try to train a mildly retarded child to utilize these cognitive strategies? The results are in a positive, upward direction--there is positive movement; but certainly not as much as there should be when we consider the intensive nature of the training programs.

In most cases these training programs are considerably much more time consuming and more structured than the training programs for learning disabled students. The results are simply not very impressive-especially

if we are to consider the important variables of maintaining the strategy over time and generalization of the strategy to other tasks with very little stimulus difference.

This leads us to a converse concept of what would happen if voluntary cognitive control strategy use was restricted for both retarded and nonretarded students during tasks that lend themselves most positively to the use of these strategies. What would happen is we blocked the use of cognitive strategies?

We did this by use of a distractor task in which all mildly retarded and non-retarded students had to count large blocks of numbers in a matrix and "remember" or hold onto either letters, designs or pictures--a task series that measures how information is processed without the use of strategies.

WE HYPOTHESIZED THAT "If voluntary cognitive control memory strategy use was restricted for both retarded and nonretarded groups of students, and the nonretarded students as a group performed significantly better than the retarded group, this remaining difference in performance cannot be attributed to voluntary control strategies alone--some other "ability" is operating to allow the nonretarded group to out-perform the retarded group in the face of these experimental limitations."

Therefore, an alternative structurally based explanation may then be theorized. Structural in the sense that something is not allowing the retarded students to effectively utilized and benefit from the continued use of cognitive strategies.

The results of the experiment showed exactly what I described above. The retarded group demonstrated slower than normal, and less efficient stimulus encoding, as well as deficits in the speed of information processing, and faster than normal stimulus decay.

This means that you may be well advised not to place as much emphasis on cognitive strategy training procedures for the mildly retarded child as you would the learning-disabled. The mildly mentally retard child's curriculum needs may very well be attended to with such tried and true procedures as environmental behavior modification, precision teaching, direct instruction, and structured drill and practice exercises.

Specifically, the experiment which I am talking about was designed as follows:

The results of this study indicated that mildly mentally retarded persons had both encoding and retention/storage memory deficits when they were required to remember stimuli from periods of immediate retrieval up to 30- seconds in length after either 3 or 5 seconds of exposure to stimuli and when memory strategies were restricted. The differences that were found in performance of the retarded group in comparison to the nonretarded group suggested slower and less efficient stimulus encoding and faster than normal stimulus decay. These findings are generally consistent with those of Caruso and Detterman (1983); Clark and Detterman (1981); Cohen and Sandberg (1977); Cohen and Netley 91978); Ellis, Deacon, and Wooldridge (1085); Ellis and Meader (1985); Ellis and Wooldridge 91985); Fagan (1984); Ferretti 91982); and Saccuzzo and Michael (1984). All of those investigators reported short-term memory deficits for retarded populations under like conditions and with similar tasks.

Structurally determined deficits were suggested as the basis for the differences between the retarded and nonretarded groups. In this study there were several similarities in the two groups in the processing of the

three different types of stimuli, but shorter encoding time appeared to have a more negative affect on the performance of the retarded than the nonretarded group.

Perhaps a combination of factors may be responsible for the deficits in short-term memory demonstrated by the retarded persons. As Ellis, Deacon, and Wooldridge 91985) stated, "To deny that there are structurally determined differences between the mental processes of retarded and nonretarded persons is tantamount to asserting that there are no limitations on retarded individuals' development of mental abilities other than those applicable to nonretarded persons. This, of course begs the question: Why are retarded persons retarded?"(p.401).

SUMMARY

This study of the effects of restricted cognitive strategy use on the short-term memory of retarded and nonretarded subjects was conceived within the framework of the Brown-Peterson paradigm (Ellis, Deacon & Wooldridge, 1985; Ellis & Meador, 1985; and Ellis & Wooldridge, 1985). It has been documented repeatedly that mentally retarded persons have greater deficits in short-term memory than nonretarded people. Some theorists have suggested that this is due to failure to use voluntary cognitive control memory strategies such as verbal rehearsal, stimulus organization, and mnemonic devices rather than to untrainable, structural limitations of the memory system. The present study was designed to identify deficient short-term memory factors that may be nontrainable, structural limitations in the memory system of educable mentally retarded subjects.

The 48 subjects were required to recall or recognize three different types of stimuli (pictures of common nouns, auditorally presented consonants, and unfamiliar designs in a match-to-sample format) after various periods of presentation and retention times. Cognitive control strategies such as verbal rehearsal, organization, mnemonic devices were interfered with by means of a rapid digit-counting distractor task. The short-term memory of the 24 mildly retarded and 24 nonretarded subjects between the ages of 10 and 14 years was observed and compared.

A repeated measures design and was used. Scheffe's post hoc pairwise comparison test was used to locate the significant differences for the response variables that showed an interaction. All measures of short-term memory were analyzed simultaneously by using the MANOVA procedure (BMDP-P4V) utilizing the three treatment conditions of nouns, consonants, and designs as the three response variables. Within subjects factors were

encoding times and retention times. In order to explore the differences between the three treatment conditions, nouns, consonants, and designs, these variables were treated as repeated measures variables by a subsequent analysis of the variance (ANOVA).

There was statistically significant evidence that the nonretarded subjects performed at a significantly higher level than the retarded group in short-term memory in all three treatment conditions. Differences between the retarded and nonretarded groups were interpreted as evidence for structurally based memory deficits in retarded persons and adds support for similar findings of other investigations of short-term memory in retarded persons.

Analysis of results indicated that even when cognitive control memory strategies were interfered with, nonretarded subjects were superior to retarded ones in short-term memory abilities for recognition of designs, recall of pictured nouns, and recall of auditorally presented consonant triads.

The differences between the 3 and 5 second encoding time for the retarded group for nouns, consonants, and designs was 8.75 per cent, 6.5 per cent, and 18.0 per cent, respectively, in favor of the 5 second encoding time. For the nonretarded group the differences were 6.0 per cent, 5.5 per, and 8.5 per cent respectively, in favor of the 5 second encoding time. However, the nonretarded group performed at a higher level at the 3 second retention time than the retarded group at the 5 second encoding time.

Stimuli retention and recall/recognition delays were significantly different for the retarded and nonretarded groups. Stimuli appeared to be encoded less efficiently, processed at a slower speeds, decay at a faster

rate in the retarded group than the nonretarded group. For the retarded group, the difference between the accuracy level at the 0- and 30- second retention times. One explanation for this is that the retarded group processed the noun stimuli as verbal material and not as imaginal material as was hypothesized. Unlike past studies in which similar tasks were used, subjects in this study were asked to name the pictures (nouns) aloud as they saw them, and thus they may have been encoded and stored as verbal stimuli and not as imagery.

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